
USACE / NAVFAC / AFCEA UFGS-L-02630N (August 2003)

Preparing Activity: LANTNAVFACENGCOM Use in lieu of UFGS-02360

UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use for LANTNAVFACENGCOM projects only

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SECTION 02630N

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08/03

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Preparing Activity: LANTNAVFACENGCOM Use in lieu of UFGS-02360

UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use for LANTNAVFACENGCOM projects only

SECTION 02630N

STORM DRAINAGE
08/03

NOTE: This guide specification covers the requirements for piping and appurtenant structures for a storm drainage system.

Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: On the project drawing, show:

1. Plan and location of all new pipelines, including type of service and size of pipe.
2. Location, size, and type of service of existing connecting, intersecting, or adjacent pipelines and other utilities.
3. Paved areas and railroads which pass over new pipelines.
4. Profile, where necessary to show unusual conditions.
5. Invert elevations at beginning and end of pipelines and at manholes or similar structures.
6. Class or strength of pipe and limits for same where class or strength will be different for different sections of pipeline. Provide shape

requirements if different shapes available.

7. Design details for pertinent manholes, catch basins, curb inlets, and head walls.

8. Store drainage lines and culverts required to be watertight.

9. Bedding conditions, where different from those specified in the appropriate NAVFAC specifications and location of cradle(s), when cradle is required if not covered under the appropriate NAVFACENGCOM specifications.

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 198	(1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
AASHTO M 252	(1994) Corrugated Polyethylene Drainage Tubing
AASHTO M 294	(1994) Corrugated Polyethylene Pipe, 305 to 915 mm (12 to 36 in.) Diameter

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(1988) Concrete Pipe Handbook
ACPA 01-103	(1990) Concrete Pipe Installation Manual

AMERICAN RAILWAY ENGINEERING & MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual	(1996) Manual for Railway Engineering (Fixed Properties)
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1996) Cast Iron Soil Pipe and Fittings
ASTM A 497	(1995) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	(1996; Rev. A) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 653/A 653M	(1996) Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 746	(1995) Ductile Iron Gravity Sewer Pipe
ASTM A 760/A 760M	(1995; Rev. B) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762/A 762M	(1995; Rev. A) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M	(1995) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 849	(1995) Posted-Applied Coatings, Pavings, and Lining for Corrugated Steel Sewer and Drainage Pipe
ASTM B 745/B 745M	(1995) Corrugated Aluminum Pipe for Sewers and Drains
ASTM B 788/B 788M	(1997) Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe
ASTM C 4	(1996) Clay Drain Tile
ASTM C 12	(1995) Installing Vitrified Clay Pipe Lines
ASTM C 14M	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 32	(1993) Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 62	(1997) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76M	(1996) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 76	(1995; Rev. A) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 139	(1997) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 150	(1997; Rev. A) Portland Cement
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 361M	(1997) Reinforced Concrete Low-Head Pressure Pipe (Metric)
ASTM C 361	(1997) Reinforced Concrete Low-Head

Pressure Pipe

ASTM C 412M	(1994) Concrete Drain Tile (Metric)
ASTM C 412	(1994) Concrete Drain Tile
ASTM C 425	(1996) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443M	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 444M	(1995) Perforated Concrete Pipe (Metric)
ASTM C 444	(1995) Perforated Concrete Pipe
ASTM C 476	(1995) Grout for Masonry
ASTM C 478M	(1996; Rev. A) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 478	(1996) Precast Reinforced Concrete Manhole Sections
ASTM C 506M	(1995; Rev. A) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 506	(1995; Rev. A) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 507M	(1995; Rev. A) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 507	(1995; Rev. A) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 564	(1995; Rev. A) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 700	(1996) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 923M	(1996) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (Metric)
ASTM C 923	(1996) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other

Gravity-Flow Applications

ASTM D 2564	(1996; Rev. A) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2680	(1995; Rev. A) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2729	(1996) Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3034	(1996) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996; Rev. A) Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals
ASTM D 4101	(1996; Rev. A) Propylene Plastic Injection and Extrusion Materials
ASTM F 402	(1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(1996; Rev. A) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 794	(1995; Rev. A) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 949	(1996; Rev. A) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(1996) Structural Welding Code - Steel
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27	Fixed Ladders
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(1998) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
FS TT-C-490	(Rev. D; Int Am. 1) Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-P-24441

(Rev. B; Supp. 1) Paint, Epoxy-Polyamide

1.2 SUBMITTALS

NOTE: Where a "G" in submittal tags follows a
submittal item, it indicates Government approval for
that item. Add "G" in submittal tags following any
added or existing submittal items deemed
sufficiently critical, complex, or aesthetically
significant to merit approval by the Government.
Submittal items not designated with a "G" will be
approved by the QC organization.

Submit the following in accordance with Section 01330, "Submittal
Procedures."

SD-02 Shop Drawings

Precast concrete structures

Metal items

SD-03 Product Data

Cast-iron soil piping including fittings and jointing materials

Clay piping including fittings and jointing materials

Concrete piping including fittings and jointing materials

Corrugated aluminum piping including fittings and jointing
materials

Corrugated steel piping including fittings and jointing materials

Composite plastic piping including fittings and jointing materials

Polyvinyl chloride (PVC) plastic piping including fittings and
jointing materials

Corrugated plastic piping including fittings and jointing materials

Subsurface drainage piping including fittings and jointing
materials

SD-04 Samples

Pipeline materials

SD-07 Certificates

Pipeline and fittings, including factory-applied linings and joint
materials

Cast-iron frames, covers, and gratings

Precast concrete structures

Submit certificates attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the frequency or intervals specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

1.3.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store [plastic piping and jointing materials and] rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.3.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.3.1.3 Cement, Aggregates, and Reinforcement

NOTE: Delete this paragraph if not used or insert applicable concrete requirements here.

Store as specified in Section [_____, "_____."]

1.3.2 Handling

Handle pipe, fittings, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. [Take special care not to damage [coating] [and] [lining] on pipe and fittings; if damaged, make repairs.] Carry, do not drag pipe to trench.

PART 2 PRODUCTS

NOTE: Allowable Piping Materials:

1. The project specification should allow the use of all piping materials for each application which are suitable for the project, each to be permitted as a Contractor's option.

2. Refer to the appropriate NAVFAC Design Manual on storm drainage for general information on piping

materials suitable for use on the applications covered by this specification. Additional information may be obtained from the "Life Cycle Cost for Drainage Structures," Technical Report GL-882-2 by the U.S. Army Corps of Engineers.

3. Pipe materials which are known to be unsuitable for local conditions (i.e., corrosion, root penetration, etc.) should not be permitted for the project. However, consideration should be given to use of more effective protective coatings and jointing methods where economically feasible.

4. In areas where problems with root penetration are anticipated, specify pipe which has the kind of joint which will successfully resist root penetration. Generally speaking, the more watertight the joint, the greater will be the resistance to root penetration. Rubber-gasketed and compression-type joints are considered to give the best performance for this application.

5. American Society of Civil Engineers (ASCE) Manual No. 37, "Design and Construction of Sanitary and Storm Sewers," contains methods of calculation for structural requirements of pipe; from these, the required strengths for pipe of various materials may be determined. Investigate external loads, including earth loads, truck loads, seismic loads, and impact, in the design stage of the project.

6. Give special attention in the design stage of the project to plastic pipe materials, particularly with respect to superimposed external loads which could cause excessive deflection of the pipe. The degree of sidefill compaction should be considered realistically, particularly in marginal cases. See also the appendices to ASTM D 2321.

2.1 PIPELINE [AND CULVERT] MATERIALS

2.1.1 Cast-Iron Soil Piping

2.1.1.1 Cast-Iron Soil Pipe and Fittings

ASTM A 74, service-weight.

2.1.1.2 Jointing Materials for Cast-Iron Soil Piping

Gaskets shall be compression-type rubber gaskets conforming to ASTM C 564.

2.1.2 Clay Piping

NOTE: Information on clay pipe may be found in the Clay Pipe Engineering Manual (1982 Edition) of the National Clay Pipe Institute.

2.1.2.1 Clay Pipe and Fittings

NOTE: Tables of trench loadings, trench backfill loads, and supporting strengths of clay pipe are included in the Clay Pipe Engineering Manual (1985 edition) of the National Clay Pipe Institute. The required strength of clay pipe can be derived from these tables when depth of trench is known.

NOTE: Specify "bell-and-spigot piping only" in areas where corrosion problems may be anticipated with the stainless steel parts of the couplings used for plain-end piping.

ASTM C 700, [standard strength] [extra strength] [bell-and-spigot piping only].

2.1.2.2 Jointing Materials for Clay Piping

ASTM C 425.

2.1.3 Concrete Piping

NOTE: For information on the selection of concrete pipe and jointing materials, see the Concrete Pipe Design Manual (1980 Edition) and the Concrete Pipe Handbook (1980 Edition), both published by the American Concrete Pipe Association. For special applications, reinforced concrete arch pipe conforming to ASTM C 506M ASTM C 506 or reinforced concrete elliptical pipe conforming to ASTM C 507M ASTM C 507 may be specified.

2.1.3.1 Concrete Pipe and Fittings

NOTE: The D-load (load per [meter] [linear foot] of diameter) must be calculated on the basis of project conditions to determine the applicable Class or strength of pipe. The Concrete Pipe Design Manual (1980 edition) of the American Concrete Pipe Association contains design information and methods by which the applicable Class or strength of pipe can be determined when depth of trench is known.

NOTE: For pipe culverts, nonreinforced pipe may be used in sizes 300 to 600 mm 12 to 24 inches in diameter, inclusive, provided that the pipe meets all applicable requirements specified for reinforced concrete pipe of equal diameter and under the same

conditions of loading.

NOTE: Sulfate resistance is required for concrete pipe when pipe is carrying sulfate-bearing waters, or when pipe is buried in soil containing sulfates. Specify Type II (moderate sulfate resisting) cement when water-soluble sulfates (as SO₄) in the soil are in the range of 0.1 to 0.2 percent and, for water, are in the range of 150 to 1,000 parts per million. Specify Type V (sulfate resisting) cement when soils contain in excess of 0.2 percent water-soluble sulfate and water samples contain in excess of 1,000 parts per million. In areas where reactive aggregates are known to occur, specify low alkali cement.

NOTE: The following are requirements for LANTNAVFACENGCOM projects: Pipe sizes under 300 mm 12 inch diameter shall be nonreinforced concrete pipe. Pipe sizes 300 mm 12 inch diameter through 600 mm 24 inch diameter may be either reinforced or nonreinforced concrete pipe. Pipe sizes larger than 600 mm 24 inch diameter shall be reinforced concrete pipe.

Storm drainage pipe shall be [nonreinforced concrete pipe conforming to ASTM C 14M ASTM C 14, Class [____]] [reinforced concrete pipe conforming to ASTM C 76M ASTM C 76, Class [____]]. [Culvert pipe shall be [Class [____] nonreinforced pipe conforming to ASTM C 14M ASTM C 14] [Class [____] reinforced pipe conforming to ASTM C 76M ASTM C 76] [Class [____] reinforced concrete arch culverts conforming to ASTM C 506M ASTM C 506] [Class [____] reinforced concrete elliptical culverts conforming to ASTM C 507M ASTM C 507].] [Circular pipe with elliptical reinforcement shall have a readily visible line no less than 300 mm 12 inches long painted or otherwise applied on the inside and outside of the pipe at each end so that when the pipe is laid in the proper position, the line will be at the center of the top of the pipe. Fittings and specials shall conform to the applicable requirements specified for the pipe and shall be of the same strength as the pipe. [Cement used in manufacturing pipe and fittings shall be [Type II] [Type V] [low alkali cement] conforming to ASTM C 150.]]

[2.1.3.2 Jointing Materials for Concrete Piping

NOTE: Choose the paragraph below or the paragraph entitled "Joint Sealants."

Gaskets and pipe ends for rubber gasket joint shall conform to ASTM C 443M ASTM C 443. Gaskets shall be suitable for use with sewage.

] [2.1.3.3 Joint Sealants

NOTE: Choose this paragraph for LANTNAVFACENGCOM projects.

NOTE: Use only ASTM C 443M ASTM C 443 rubber O-ring gaskets for airfield pavement areas. Delete other options.

Provide primers and lubricants as recommended by the manufacturer. Concrete pipe joints shall be suitable for use with the joint sealants specified.

- a. Butyl gaskets.
- b. ASTM C 443M ASTM C 443 rubber O-ring gaskets.
- c. AASHTO M 198, Type B preformed plastic gaskets.

2.1.1.4 Corrugated Aluminum Piping

NOTE: Information on corrugated metal pipe may be found in the U.S. Dept. of Transportation, Federal Highway Administration, Bureau of Public Roads publication, "Corrugated Metal Pipe," the American Iron and Steel Institute publications, "Modern Sewer Design" and "Handbook of Steel Drainage and Highway Construction Products," in the National Corrugated Steel Pipe Association Technical Manual, "Corrugated Metal Drainage Structures," and in the Aluminum Association's "Aluminum Drainage Products Manual."

NOTE: Corrugated aluminum pipe has shown satisfactory corrosion resistance in clean granular materials even when seawater is present. However, corrugated aluminum pipe should not be used in highly acid (pH below 4) or highly alkaline (pH above 9) soils, or in organic silts and clays, identified as Types OH and OL in the Soil Classification Chart, ASTM D 2487. This pipe should also not be used where it will be in contact with other metals or in metallic deposits.

2.1.4.1 Corrugated Aluminum Pipe and Fittings

NOTE: Delete the sentence regarding riveted pipe when watertight joints are not required.

NOTE: The information in this note are requirements for LANTNAVFACENGCOM projects: Provide ASTM A 849, Type B, C, M, and P with fully coated, half coated,

exterior coated, interior coated, invert coated,
invert paved, and fully lined. Do not use Type C,
concrete lining on aluminum materials.

ASTM B 745/B 745M, Type [I, [annular] [helical] corrugations] [IA, [_____] liner thickness] [IR] [II, [annular] [helical] corrugations] [IIA] [III], and [_____] sheet thickness. [Type IR pipe shall have a circular cross section with a smooth sheet of constant thickness and helical ribs projecting outwardly.] [Corrugation size shall be [_____] by [_____] mm inch.] Fabricate fittings of the same material as the pipe, of strength at least comparable to that of the pipe, and the same size and shape of corrugations as the pipe. [On riveted pipe and fittings the longitudinal seam rivets which would be under the coupling band shall be omitted and that portion of the seam shall be welded.] [Bituminous coating shall conform to ASTM A 849 Type [_____] .] [For hugger-type coupling bands, pipe shall have factory rolled annular corrugations at each end.]

2.1.4.2 Jointing Material for Corrugated Aluminum Piping

NOTE: Delete bracketed portion(s) of paragraph when
watertight joints are not required.

NOTE: Specify oil resistance when necessary in
accordance with available classes.

NOTE: Coupling bands with projections (dimples) are
not recommended for watertight joints.

Coupling bands shall have the same size and shape corrugations as the piping to which the bands are to be connected and shall conform to ASTM B 745/B 745M[, except that connecting angles shall be omitted and the circumference of the band shall be such that when coupled, a 75 mm 3 inch lap will be provided. [Do not use coupling bands with projections.] For tightening each coupling band, provide four 13 mm 1/2 inch diameter zinc-coated steel rod hoops with silo lugs. Gaskets shall be cylindrical in shape, fabricated of 10 mm thick by 163 mm 3/8 inch thick by 6 1/2 inch minimum; diameter of cylindrical gasket shall be 10 percent less than the nominal pipe diameter.] [Coupling bands may also be hugger type, having a flat central section with a corrugated section near each end designed to mesh with the annular corrugations on the pipe, and with two bolt steel bar-and-strap connectors. Gaskets for use with hugger type bands shall be O-ring type, 30 mm 1 3/16 inch diameter, conforming to the requirements specified for rubber gaskets in ASTM C 361M ASTM C 361.]

2.1.5 Corrugated Steel Piping

NOTE: Information on corrugated metal pipe may be
found in the U.S. Dept. of Transportation, Federal
Highway Administration, Bureau of Public Roads
publication, "Corrugated Metal Pipe," the American
Iron and Steel Institute publications, "Modern Sewer

Design" and "Handbook of Steel Drainage and Highway Construction Products," in the National Corrugated Steel Pipe Association Technical Manual, "Corrugated Metal Drainage Structures," and in the Aluminum Association's "Aluminum Drainage Products Manual."

NOTE: Corrugated steel pipe is also available in a form called "nestable culvert pipe." This pipe is furnished in semi-cylindrical pieces which are fastened together on the job site to form a pipeline of round cross section. Nestable culvert pipe was developed as a means of conserving shipping and storage space, and its use should be considered when such space is at a premium, as in some overseas projects, etc. When specified, nestable culvert pipe should conform to MIL-P-236.

2.1.5.1 Corrugated Steel Pipe and Fittings

NOTE: Delete the last sentence regarding riveted pipe, when watertight joints are not required.

NOTE: For LANTNAVFACENGCOM projects, delete the third and fourth sentences and add the last sentence with subparagraphs a. "Annular Corrugations" and b. "Helical Corrugations."

ASTM A 760/A 760M, [ASTM A 762/A 762M] Type [I, [annular] [helical] corrugations] [IA, [_____] liner thickness] [IR] [II, [annular] [helical] corrugations] [IIA] [III], [IIIA], and [_____] sheet thickness. [Corrugation size shall be [_____] by [_____] mm inch.] Steel sheet for pipe shall be [zinc-coated] [aluminum-coated] [or] [aluminum-zinc alloy coated] [and polymer precoated, Grade [_____]]. [Bituminous coating shall conform to ASTM A 849, Type [_____]].] Fabricate fittings of the same material as the pipe with strength not less than that of the pipe, and having the same size and shape of corrugations as the pipe. Helically corrugated pipe and fittings, when used with hugger-type coupling bands, shall have factory-rolled annular corrugations at each end. [On riveted pipe and fittings the longitudinal seam rivets which would be under the coupling band shall be omitted and that portion of the seam shall be welded.] [Provide [coating] [and] [paving] as follows:

NOTE: Use the following subparagraphs a. "Annular Corrugations" and b. "Helical Corrugations" for LANTNAVFACENGCOM projects.

NOTE: Corrugated steel piping in accordance with ASTM A 885 (aramid fiber composite coating) is recommended for use where severely corrosive

conditions, such as highly acid soils, tidal drainage, mine drainage, and certain industrial wastes, are present.

- a. Annular corrugations: [Fully bituminous coated, half paved, for pipe diameters less than 450 mm 18 inches] [and] [fully bituminous coated, fully paved, for pipe diameters 450 mm 18 inches and larger].]
- b. Helical corrugations: Helically-corrugated pipe and fittings, when used with pipe joints, shall have a minimum of two factory-rolled annular corrugations at each end. [Fully bituminous coated for pipe diameters 450 mm 18 inches and smaller] [and] [fully bituminous coated, fully paved, or fully concrete lined conforming to ASTM A 849, Type C-3 for pipe diameters larger than 450 mm 18 inches].

2.1.5.2 Jointing Materials for Corrugated Steel Piping

NOTE: Delete bracketed portion(s) of paragraph when watertight joints are not required.

NOTE: Specify oil resistance when necessary in accordance with available classes.

NOTE: Coupling bands with projections (dimples) are not recommended for watertight joints.

Coupling bands shall be as specified in ASTM A 760/A 760M [ASTM A 762/A 762M] [, unless otherwise specified. Connecting angles shall be omitted and the circumference of the band shall be such that when coupled, a 75 mm 3 inch lap will be provided. [Do not use coupling bands with projections.] Coupling bands shall be bituminous coated to a minimum thickness of 1.25 mm 0.05 inch [except that coupling bands for polymer precoated pipe shall have [the same polymer precoating as the pipe] [bituminous coating] [the same metallic coating as the pipe only]]. For tightening each coupling band, provide four 38 mm 1 1/2 inch diameter zinc-coated steel rod hoops with silo lugs. Gaskets shall be cylindrical in shape, fabricated of 10 mm thick by 163 mm 3/8 inch thick by 6 1/2 inch minimum width rubber, diameter of cylindrical gasket shall be 10 percent less than the nominal pipe diameter]. Coupling bands may also be hugger type, having a flat central section with a corrugated section near each end designed to mesh with the annular corrugation on the pipe, and with two-bolt steel bar-and-strap connector. [Gaskets for use with hugger type bands shall be O-ring type, 30 mm 1 3/16 inch diameter, conforming to requirements specified for rubber gaskets in ASTM C 361M ASTM C 361.]

2.1.6 Composite Plastic Piping

NOTE: Allowable pipe sizes for LANTNAVFACENGCOM projects are 250 mm 10 inch diameter or less.

2.1.6.1 ABS Composite Plastic Pipe and Fittings

Acrylonitrile-Butadiene Styrene (ABS) or Poly(Vinyl Chloride) (PVC) composite pipe and fittings, ASTM D 2680.

2.1.6.2 Jointing Materials for ABS Composite Plastic Piping

ASTM D 2680 solvent cement and primer or ASTM D 3212 elastomeric gasket joints. Ends of pipe and fittings shall be suitable for either Type SC or Type OR joints.

2.1.7 Polyvinyl Chloride (PVC) Plastic Piping

NOTE: Use subparagraphs "PVC Plastic Pipe and Fittings" and "Joints and Jointing Material for PVC Plastic Piping" for other than LANTNAVFACENGCOM projects. The last option paragraph is to be used for LANTNAVFACENGCOM projects.

2.1.7.1 PVC Plastic Pipe and Fittings

ASTM D 3034, shall be SDR 35, having ends adaptable for elastomeric gasket joints.

2.1.7.2 Joints and Jointing Material for PVC Plastic Piping

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

NOTE: The following is a regional requirement to be used when applicable for LANTNAVFACENGCOM projects. The requirements may be used for other areas if appropriate.

NOTE: Give special attention in the design stage of the project to plastic pipe materials, particularly with respect to superimposed external loads which could cause excessive deflection of the pipe. The degree of sidefill compaction should be considered realistically, particularly in marginal cases.

[Polyvinyl Chloride (PVC) Pipe and Fittings, 250 mm 10 Inch Diameter and Smaller: ASTM D 3034, SDR 35, with ends suitable for elastomeric gasket joints. ASTM F 949 with solvent cement joints or elastomeric gasket joints. ASTM D 3212 elastomeric gasket joints, ASTM D 2564 solvent cement joints and ASTM F 477 gaskets.]

2.1.8 Corrugated Plastic Piping

NOTE: This is a regional requirement to be used when applicable for NORTHNAVFACENGCOM projects. The

requirements may be used for other areas if appropriate.

2.1.8.1 Pipe and Fittings

[Corrugated poly(vinyl chloride) (PVC) pipe conforming to ASTM F 794] [or] [corrugated, high density polyethylene pipe (HDPE) conforming to] [AASHTO M 252] [or] [AASHTO M 294, Type [____]]. [PVC fittings with solvent cemented components shall conform to ASTM D 2855 and ASTM F 402.]

2.1.8.2 Joints and Jointing Materials

[ASTM D 3212 for PVC pipe joints] [or] [manufacturer's recommendations for HDPE joints].

2.1.9 Piping Beneath Railroad Right-Of-Way

Where pipeline passes under the right-of-way of a commercial railroad, piping shall conform to the specifications for pipelines conveying nonflammable substances in Chapter 1, Part 5 of AREMA Manual, unless otherwise specified. For casing pipe provide ductile-iron pipe in lieu of cast-iron pipe. Ductile-iron pipe shall conform to and have strength computed in accordance with ASTM A 746.

2.1.10 Subsurface Drainage Piping Materials

NOTE: This is a regional requirement to be used when applicable for WESTNAVFACENGCOM projects. The requirements may be used for other areas if appropriate.

2.1.10.1 Clay Drain Tile

ASTM C 4, [standard] [extra-quality] [heavy-duty].

2.1.10.2 Concrete Drain Tile

ASTM C 412MASTM C 412, [standard-quality] [extra-quality] [heavy-duty extra quality] [special quality].

2.1.10.3 Perforated Clay Pipe

ASTM C 700, [standard strength] [extra strength].

2.1.10.4 Perforated Concrete Piping

ASTM C 444MASTM C 444, and applicable requirements of ASTM C 14M ASTM C 14, Class [____].

2.1.10.5 Perforated Corrugated Steel Piping

ASTM A 760/A 760M, Type III, zinc-coated.

2.1.10.6 Perforated Corrugated Aluminum Piping

ASTM B 745/B 745M, Type III.

2.1.10.7 Perforated Polyvinyl Chloride (PVC) Piping

ASTM D 2729.

2.1.10.8 Requirements Governing Piping

NOTE: Sulfate resistance is required for concrete pipe when pipe is carrying sulfate-bearing waters, or when pipe is buried in soil containing sulfates. Specify Type II (moderate sulfate resisting) cement when water-soluble sulfates (as SO₄) in the soil are in the range of 0.1 to 0.2 percent and, for water, are in the range of 150 to 1,000 parts per million. Specify Type V (sulfate resisting) cement when soils contain in excess of 0.2 percent water-soluble sulfate and water samples contain in excess of 1,000 parts per million. In areas where reactive aggregates are known to occur, specify low alkali cement.

[The clear diameter of each perforation in [corrugated steel] [or] [corrugated aluminum] pipe after coating shall be not less than 75 percent of the diameter of the perforation before coating.] [Cement for concrete pipe shall be [Type II] [Type V] [low alkali cement] conforming to ASTM C 150.] Use nonperforated fittings of the same material and strength where necessary, that conform to the applicable specifications specified for fittings.

2.1.10.9 Jointing Materials

Couplings for [perforated corrugated aluminum pipe] [and] [perforated corrugated steel pipe] shall be as specified in the respective specifications for the pipe. Tar paper, reinforced building paper, roofing paper, glass fiber fabric, or other approved materials shall be used for covering open joints in drain tile.

2.2 CONCRETE MATERIALS

NOTE: Delete this paragraph if not used or insert applicable concrete requirements here.

Provide as specified in Section [_____, "_____."]

2.3 MISCELLANEOUS MATERIALS

2.3.1 Drainage Structures

Construct of clay brick, solid concrete masonry units or concrete, except that airfield catch basins, headwalls, gutters, top of curb inlets, and bases shall be concrete. Precast structures may be provided in lieu of cast-in-place concrete except for airfield catch basins, headwalls, and gutters. Pipe-to-wall connections shall be mortared to produce smooth transitions and watertight joints or provided with ASTM C 923M ASTM C 923 resilient connectors. Bases shall have smooth inverts accurately shaped to

a semicircular bottom conforming to the inside contour of the adjacent sewer sections. Changes in direction of the sewer and entering branches into the manhole shall have a circular curve in the manhole invert of as large a radius as the size of the manhole will permit.

2.3.1.1 Precast Concrete Structures

ASTM C 478, except as specified herein. Provide [an air content of 6 percent, plus or minus 2 percent and] a minimum wall thickness of 125 mm 5 inches. ASTM A 615/A 615M reinforcing bars. ASTM A 497 welded wire fabric. ASTM C 443M ASTM C 443 or AASHTO M 198, Type B gaskets for joint connections. Provide a 100 mm 4 inch layer of clean gravel bedding with a maximum size of 50 mm 2 inches.

2.3.2 Masonry Materials

Shall conform to the following specifications and other requirements specified hereunder.

2.3.2.1 Brick

ASTM C 32, Grade MS, or ASTM C 62, Grade SW, except that the absorption test will be waived.

2.3.2.2 Concrete Masonry Units

ASTM C 139.

2.3.2.3 Mortar

ASTM C 270, Type M.

2.3.2.4 Water

Water for masonry mortar shall be fresh, clean, potable.

2.3.2.5 Grout

ASTM C 476.

2.3.3 Metal Items

2.3.3.1 Frames, Covers, and Gratings

NOTE: For projects where FS A-A-60005 is not appropriate, include frame, cover, and grating design requirements on the drawings. Provide ductile iron option if available and meets load requirements.

FS A-A-60005, Style 2 is unsafe for use in areas with bicycles.

Shall be cast iron conforming to FS A-A-60005, figure numbers [as follows] [as indicated]. Fabricate frames, covers, and gratings for airfield use of standard commercial grade steel [or ductile iron], welded by qualified welders in accordance with AWS D1.1/D1.1M. Covers shall be of rolled steel

floor plate [or ductile iron] having an approved anti-slip surface. Steel gratings shall be of commercial grade steel [or ductile iron] and be of welded construction.

- a. Traffic manhole: Provide in paved areas.

[For solid circular cover and frame use:

Frame: Figure 1, Size 22A

Cover: Figure 8, Size 22A

Steps: Figure 19]

[For grated circular frames and covers:

a. Frame: Figure 1, Size 22A

b. Cover: Figure 13, Size 22A, Style [1][2]

c. Steps: Figure 19]

[For square frames and covers:

a. Frame: Figure 6, Type VI

b. Cover: Figure 14, 22A, Style [1][2]

c. Steps: Figure 19]

- b. Non-traffic manhole:

[For circular solid frames and covers:

Frame: Figure 4, Size 22

Cover: Figure 12, Size 22

Steps: Figure 19]

[For grated circular frames and covers:

Frame: Figure 1, Size 22A

Cover: Figure 15, Size 22, Style [1][2]

Steps: Figure 19]

[For square frames and covers:

Frame: Figure 6, Type VI

Cover: : Figure 14, 22A, Style [1][2]

Steps: Figure 19]

2.3.3.2 Drainage Structure Steps

[Zinc-coated steel] [as indicated] conforming to 29 CFR 1910.27. [As an option, plastic or rubber coating pressure-molded to the steel may be used.

Plastic coating shall conform to ASTM D 4101, copolymer polypropylene.

Rubber shall conform to ASTM C 443M ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5.] [For curb inlets, steel sump ladder rungs as indicated may be used in lieu of cast-iron steps; rungs shall be zinc-coated after fabrication.] Aluminum steps or rungs will not be permitted. Steps are not required in manholes [, curb inlets,] or catch basins less than 1.2 m 4 feet deep.

2.4 FLARED ENDS

Flared end sections shall be same material as pipe material except that only reinforced concrete flared ends shall be provided for concrete pipe. [Flared ends are included in the lengths of pipe indicated.]

2.5 EROSION CONTROL RIPRAP

Provide nonerrodible rock not exceeding 375 mm 15 inches in its greatest

dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of [200 mm] [8 inches] [as indicated].

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation except where specific exception is made under paragraph entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 1.5 m 5 feet from the building [, unless otherwise indicated on the drawings].

3.1.1.2 Earthwork

NOTE: Earthwork requirements for pipe trenches are covered in Section 02302, "Excavation, Backfilling, and Compacting for Utilities." The applicable requirements which are set forth in Section 02302 must be incorporated into the project specification, whether in Section 02302 or in an all-inclusive earthwork section. The above referenced section number and title is subject to change. The specifier should verify the current appropriate specification and revise as necessary if different.

Perform earthwork operations in accordance with Section [_____, "_____."]

3.1.1.3 Pipe Laying and Jointing

NOTE: Delete requirements for tongue-and-groove pipe (concrete pipe) when not allowed for the project.

Inspect each pipe and fitting before and after installation; remove those found defective from site and replace with new. Provide proper facilities for lowering sections of pipe into trenches. Lay pipe with the bell [or groove] ends in the upgrade direction. Adjust spigots in bells [and tongues in grooves] to produce a uniform space. Blocking or wedging between bells and spigots [or tongues and grooves] will not be permitted. Replace by one of the proper dimensions any pipe or fitting that does not allow sufficient space for proper calking or installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 7.5 m 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

3.1.1.4 Connections to Existing Lines

Notify Contracting Officer in writing at least 10 days prior to date that connections are to be made. Obtain approval of the Contracting Officer before interrupting service. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of Cast-Iron Soil Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the pipe manufacturer. Make joints with the rubber gaskets specified for joints with this piping; assemble in accordance with the recommendations of the pipe manufacturer.

3.1.2.2 Installation of Clay Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM C 12 for pipe laying. Make joints with a compression joint material specified for joints with this piping and assemble in accordance with the recommendations of the manufacturer of the pipe.

3.1.2.3 Installation of Concrete Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the provisions for rubber gasket jointing and jointing procedures of ACPA 01-103 or of ACPA 01-102, Chapter 9. Make joints with the gaskets previously specified for joints with this piping. Clean and dry surfaces receiving lubricants, cements, or adhesives. Affix gaskets to pipe not more than 24 hours prior to the installation of the pipe. Protect gaskets from sun, blowing dust, and other deleterious agents at all times. Before installation of the pipe, inspect gaskets and remove and replace loose or improperly affixed gaskets. Align each pipe section with the previously installed pipe section, and pull the joint together. If, while pulling the joint, the gasket becomes loose and can be seen through the exterior joint recess when the pipe is pulled up to within 25 mm one inch of closure, remove the pipe and remake the joint.

3.1.2.4 Installation of Corrugated Metal Piping

Install [corrugated aluminum] [and] [corrugated steel] pipe, and fittings in accordance with the general requirements for installation of pipelines and with the recommendations of [ASTM B 788/B 788M] [and] [ASTM A 798/A 798M] [, respectively], except as otherwise specified in the other subparagraphs hereunder.

- a. Pipe laying: Handle pipe carefully so as not to damage [coating] [and] [paving]. If damage occurs, give damaged areas of pipe and couplings an application of [coating] [and] [paving] equal to that specified for the pipe [; remove pipe on which [coating] [and] [paving] has been damaged to such extent that satisfactory repairs cannot be made and replace with new, as determined by the Contracting Officer]. [Install paved invert corrugated metal pipe with the paved area centered at the bottom.]

NOTE: In the text below, delete fifth sentence,

regarding filling of annular space, except when pipe 750 mm 30 inches in diameter and larger is included in the project. Delete reference to pipe size except when necessary to differentiate from corrugated metal pipe of less than 750 mm 30 inch diameter which is also included in the project.

NOTE: Watertight joints should be specified for drainage and culvert piping in areas where maximum watertightness is considered essential and particularly in areas of high water table and root penetration problems. In these cases, rubber-gasketed or compression-type joints are preferred.

- b. Jointing: Make [standard coupling band] [watertight] joints using the coupling bands previously specified for this purpose. In making pipe joints, keep space between pipe and coupling free from dirt and grit so that corrugations will fit snugly. While tightening the coupling band, tap it with a soft-head mallet of wood, rubber, or plastic to take up slack and ensure a tight joint. [Assemble standard coupling band joints in accordance with the recommendations of the pipe manufacturer. [Fill the annular space between abutting sections of [[_____] mm inch size] paved invert pipe with bituminous material after jointing.]] [Make watertight joints in the following manner: Place cylindrical gasket over one end of the pipe section in place for half the width of the gasket; double over the other half of the gasket back onto the half of the gasket already in place on the pipe end. When the adjoining pipe section is in place, roll the doubled-over half of the gasket over onto the end of this adjoining pipe section. Correct unevenness in overlap so that gasket covers ends of pipe sections evenly. Use lubricants with gasket as recommended by manufacturer. Center coupling band in position over the joint and draw tight by means of the four 13 mm 1/2 inch diameter steel rod hoops and silo lugs until the ends of the coupling band lap 75 mm 3 inches under the lugs. With hugger-type coupling bands, make joints using O-ring gaskets; assemble in accordance with the recommendations of the pipe manufacturer.]

3.1.2.5 Installation of ABS or PVC Composite Plastic Piping

Install pipe and fittings in accordance with the "General Requirements for Installation of Pipelines" and with the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint; assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

3.1.2.6 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with the "General Requirements for Installation of Pipelines" and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping; assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe

manufacturer.

3.1.2.7 Installation of Corrugated Plastic Piping

Install pipe and fittings in accordance with the "General Requirement for Installation of Pipelines" and with the recommendations of the [PVC] [or] [HDPE] pipe manufacturer.

3.1.2.8 Installation Beneath Railroad Right-Of-Way

Where pipeline passes under the right-of-way of a commercial railroad, install piping [by the boring and jacking method] in accordance with the specifications for pipelines conveying nonflammable substances in Chapter 1, Part 5, of AREMA Manual.

3.1.2.9 Installation of Subsurface Drainage Piping

**NOTE: This is a regional requirement to be used
when applicable for WESTNAVFACENGCOM projects. The
requirements may be used for other areas if
appropriate.**

Laying and jointing shall be in accordance with paragraph entitled "General Requirements for Installation of Piping" of this section, except as specified hereinafter, and with the additional requirements specified hereinafter.

- a. Laying and jointing: The laying of pipe and tile shall proceed upgrade from the lower end of the line, and shall have a uniform pitch to the outlets. Lay drain tile with 3 to 6 mm 1/8 to 1/4 inch open joints. Joints between the tile shall be covered with one thickness of the jointing material specified; material shall overlap the joint not less than 100 mm 4 inches on each side and shall cover the tile for not less than the upper half or more than the upper two-thirds of the circumference of the tile. [[Lay perforated clay pipe] [and] [perforated concrete pipe] without filling the pipe joints, but with positive provision for centering each section of pipe in the bell [or groove] of the placed section.] [[Perforated corrugated aluminum pipe] [and] [perforated corrugated steel pipe] shall have joints made with standard coupling bands in a manner approved by the Contracting Officer.] Provide vertical pipe at the high points in each drain run, for testing purposes. Connect the vertical pipe sections into the drains by means of tees, and extend to the height indicated. Fit the upper hub ends with screwed plugs. Make joints in cast-iron sections with fiber gaskets and 1 to 2 portland cement mortar.

3.1.3 Concrete Work

**NOTE: Delete this paragraph if not used or insert
applicable concrete requirements here.**

Perform cast-in-place concrete work in accordance with Section [_____,
"_____."]

3.1.4 Manhole [, Curb Inlet,] and Catch Basin Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent drainage sections. For changes in direction of drains and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. For precast concrete construction, make joints between sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Give a smooth finish to inside joints of precast concrete manholes [, curb inlets,] and catch basins. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the paragraph entitled, "Concrete Work." Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose or mortared to produce a watertight joint; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as required to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding beyond into the manhole.

3.1.5 Metal Work

3.1.5.1 Workmanship and Finish

**NOTE: Provide paint system acceptable in project's
locality. See Section 09900, "Paints and Coatings"
for guidance.**

Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron [and steel] to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide rabbets, lugs, and brackets wherever necessary for fitting and support. [Apply zinc coating to steel gratings after fabrication in accordance with ASTM A 653/A 653M.] [Clean surfaces of steel frames and covers to bare metal by a blasting process. Where surfaces cannot be cleaned satisfactorily by blasting, clean to bare metal by wire brushing or other mechanical means. For surfaces contaminated with rust, dirt, oil, grease, or other contaminants, wash with solvents until thoroughly clean. Immediately after cleaning, coat surfaces with a coat of pretreatment coating, MIL-P-24441, applied to a dry film thickness of 0.008 to 0.013 mm 0.3 to 0.5 mil; or apply a crystalline phosphate coating, FS TT-C-490, Method I, Type II. As soon as practicable after the pretreatment coating has dried, prime treated surfaces with a coat of [_____] applied to a minimum dry film thickness of [_____] mm mils. If primed surfaces are damaged before removal from the shop, retouch with primer.]

3.1.5.2 Field Painting

NOTE: Provide paint system acceptable in project's
locality. See Section 09900, "Paints and Coatings"
for guidance.

[After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint.] [After installation, clean steel covers and steel or concrete frames not buried in masonry or concrete to bare metal of mortar, dirt, grease, and other deleterious materials. Apply a coat of primer, [____], to a minimum dry film thickness of [____] mm mil; and apply a top coat, [____] to a minimum dry film thickness of [____] mm mils, color optional.] Do not paint surfaces subject to abrasion.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing [, except that water and electric power needed for field tests will be furnished as set forth in Section [____, "____."]] Be able to produce evidence, when required, that each item of work has been constructed properly in accordance with the drawings and specifications.

3.2.2 Pipeline Testing

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

3.2.2.1 Leakage Tests

NOTE: Delete the paragraph when watertight joints
are not required.

NOTE: In the 5th sentence, use 1st optional wording
in connection with exfiltration test requirements
except where the line or any test portion thereof is
of such slope that the testing water will cause an
excessively high pressure on the lower part of the
line. In this case, for the entire line or the
applicable portion, the test requirements should be
modified accordingly for the project conditions.

NOTE: In the 8th sentence, use 1st optional wording
if it meets project requirements. For other cases,
leakage rates may be determined for infiltration and
exfiltration tests as specified in Section 02530,
"Sanitary Sewerage."

**NOTE: Delete for LANTNAVFACENGCOM projects that do
not have bell-and-spigot joint piping.**

Test lines for leakage by either infiltration tests or exfiltration tests. Prior to testing for leakage, backfill trench up to at least the lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When the water table is 600 mm 2 feet or more above top of pipe at upper end of pipeline section to be tested, measure infiltration using a suitable weir or other acceptable device. When the water table is less than 600 mm 2 feet above top of pipe at upper end of pipeline section to be tested, make exfiltration test by filling the line to be tested with water so that the head will be [at least 1.2 m 4 feet above top of pipe at upper end of pipeline section being tested] [____]. Allow filled pipeline to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, re-establish the head and measure amount of water needed to maintain this water level during a 2 hour test period. Amount of leakage, as measured by either infiltration or exfiltration test shall not exceed [47] [____] liters per millimeter of diameter per day per kilometer [500] [____] gallons per inch of diameter per day per mile of pipeline. When leakage exceeds the amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

3.2.2.2 Deflection Testing

**NOTE: Delete when no plastic piping has been
allowed for the project. Specify only when
warranted by scope or size of project or when a high
degree of watertightness is required.**

NOTE: Delete for all LANTNAVFACENGCOM projects.

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

- a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device. Ball, cylinder, or circular sections shall conform to the following:

(1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

(2) A homogeneous material throughout, with a density greater than 1.0 as related to water at 4 degrees C 39.2 degrees F, and a surface Brinell hardness of not less than 150.

(3) Center bored and through bolted with a 6 mm 1/4 inch minimum diameter steel shaft having a yield strength of not less than 483 MPa 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.

(4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

- b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved by the Contracting Officer prior to use.
- c. Pull-through device: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflection, replace with new pipe, and completely retest in same manner and under same conditions.
- e. Warranty period test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of one-year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.2.3 Field Tests for Concrete

**NOTE: Delete this paragraph if not used or insert
applicable concrete requirements here.**

Field testing requirements are covered in Section 03300N, "Cast-In-Place Concrete."

-- End of Section --